



ONline Ethernet 10BASE-FB Module Installation and Operation Guide

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Model Number: 510M-FBP
5102M-FBP
5104M-FB1

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The ONcore Switching Hub, ONline System Concentrator, and ONsemble StackSystem Hub are manufactured to the International Safety Standard EN 60950 and are approved in the UK under the General Approval Number NS/G/12345/J/100003 for indirect connection to the public telecommunication network.

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How to Use This Guide

This guide is designed to help you understand the features, indicators, and installation procedures for the:

- ❑ 3Com ONline™ Ethernet Port-Switching 10BASE-FB Modules (Model Numbers 5102M-FBP and 5104M-FBP)
- ❑ 3Com ONline™ Ethernet 10BASE-FB Module (Model Number 5104M-FB1)

This guide also contains information on troubleshooting and diagnostics for operation verification. In addition, a configuration section provides you with network configuration information.

Audience

This guide contains instructions for installing the modules and maintaining normal operation. It is intended for the following people at your site:

- ❑ Hardware installer
- ❑ System/Network manager

Structure of This Guide

This guide contains the following chapters:

Chapter 1, Introduction – Introduces the principal features of the ONline Ethernet Port-Switching 10BASE-FB Modules and the ONline Ethernet 10BASE-FB Module.

Chapter 2, Designing and Expanding the Network – Contains configuration information to help you integrate the 10BASE-FB Modules into your Ethernet network.

Chapter 3, Installing and Operating the Module – Provides illustrated procedures for installing the 10BASE-FB Modules into the ONline System Concentrator and configuring them for operation. This chapter also provides a front panel view of the 10BASE-FB Modules showing ports, LEDs, and dip switches.

Chapter 4, Troubleshooting – Provides help in isolating and correcting problems that could arise during the installation process and during normal operation.

Appendix A, Specifications – Describes product dimensions, power requirements, and other specifications for the modules.





Appendix B, Technical Support – Lists the various methods for contacting the 3Com technical support organization and for accessing other product support services.

Index – Contains an alphabetical list of important terms and features referenced throughout this guide.

Document Conventions

The following document conventions are used in this manual:

Convention	Indicates	Example
Courier text	User input	In the Agent Information Form, enter <code>MIS</code> in the New Contact field.
	System output	After pressing the Apply button, the system displays the message <code>Transmitting data.</code>
Bold command string	Path names	Before you begin, read the <code>readme.txt</code> file located in <code>/usr/snm/agents</code> .
Text in angled brackets	User-substituted identifiers	In the command above, substitute <code><rem_name></code> with the name of the remote machine.
Capitalized text in plain brackets	Keyboard entry by the user	Type your password and press <code>[ENTER]</code> .
Italics	Text emphasis, document titles	Ensure that you press the Apply button <i>after</i> you add the new search parameters.

Convention	Indicates	Example
Note:	A Note . The information is important	Note: Use STP lobe cables for your system.
 Caution:	A Caution . A condition may damage software or hardware	 Caution: Do not put your installation diskettes on a magnetic surface. This may damage the diskettes.
 Warning:	A Warning . A condition may threaten personal safety	 Warning: Wear eye protection when performing these maintenance procedures.

Related Documents

This section provides information on supporting documentation, including:

- ☐ 3Com Documents
- ☐ Reference Documents

3Com Documents

The following documents provide additional information on 3Com products:

17-Slot ONline System Concentrator Installation and Operation Guide – Explains how to install, operate, and manage the 3Com ONline 17-Slot System Concentrator (Models 5017C-LS and 5017C with load sharing).

6-Slot ONline System Concentrator Installation and Operation Guide – Explains how to install, operate, and manage the 3Com ONline 6-Slot System Concentrator.

ONline Ethernet Management Module Installation and Operation Guide – Describes how to install the ONline Ethernet Management Module in the ONline System Concentrator and explains the LEDs on the module faceplate. This guide also provides instructions for connecting a terminal to the module and describes the management commands necessary to perform management tasks on the concentrator and on remote devices.

ONline Management Commands Guide – Provides an alphabetized reference resource describing all ONline management commands.

For a complete list of 3Com documents, contact your 3Com representative.

Reference Documents

The following documents supply related background information:

Case, J., Fedor, M., Scoffstall, M., and J. Davin, *The Simple Network Management Protocol*, RFC 1157, University of Tennessee at Knoxville, Performance Systems International and the MIT Laboratory for Computer Science, May 1990.

Rose, M., and K. McCloghrie, *Structure and Identification of Management Information for TCP/IP-based Internets*, RFC 1155, Performance Systems International and Hughes LAN Systems, May 1990.

1

Introduction

This chapter introduces you to the:

- ❑ 3Com ONline™ Ethernet Port-Switching 10BASE-FB Modules (5102M-FBP and 5104M-FBP)
- ❑ 3Com ONline™ Ethernet 10BASE-FB Module (5104M-FB1)

The modules are referred throughout this guide as the 10BASE-FB Modules. Information in this guide refers to all three 10BASE-FB Modules listed above. Differences between the modules are noted where applicable.

This chapter contains the following sections:

- ❑ 10BASE-FB Module Descriptions
- ❑ 10BASE-FB Compliance
- ❑ 10BASE-FB Theory of Operation
- ❑ Compatibility With Other Ethernet Fiber Products

10BASE-FB Module Descriptions

The ONline Ethernet Port-Switching 10BASE-FB Module is a 2- or 4-port, Ethernet fiber module designed for 3Com Online System Concentrators. The ONline Ethernet 10BASE-FB Module is a 4-port, Ethernet fiber module also designed for 3Com Online System Concentrators.

The ONline Ethernet Port-Switching 10BASE-FB Module (Model Number 5104M-FBP) is functionally identical to the ONline Ethernet 10BASE-FB Module (Model Number 5104M-FB1) *except* for the Port-Switching Module's ability to set each port to an independent backplane network in the concentrator.

The 5104M-FB1 is module-switching only. You can update the 10BASE-FB Module to a port-switching module by installing the ONline Ethernet 10BASE-FB Upgrade Kit.

The 10BASE-FB Modules provide:

- ❑ Fiber backbone connectivity for Ethernet local area networks
- ❑ Direct fiber to-the-desk connectivity

You can directly connect the 10BASE-FB Modules to any other ONline fiber module as well as all of the products in the 3Com 10BASE-FB family, including the:

- ❑ 3Com 10BASE-FB Star Coupler
- ❑ 3Com 10BASE-FB Fiber Transceiver
- ❑ 3Com Fault-Tolerant 10BASE-FB Transceiver

The 10BASE-FB Modules:

- ❑ Provide up to 4.0 kilometers distance between any two concentrators
- ❑ Support network diameters up to 4.2 kilometers
- ❑ Contain built-in link redundancy for fault tolerance

- ❑ Include diagnostics for troubleshooting
- ❑ Provide 10 Mbps performance with 100 percent collision detection using CSMA/CD
- ❑ Support 50, 62.5, 85, and 100 μ m fiber cable
- ❑ Are shipped with either ST, SMA, or FC-type connectors

Other benefits of the 10BASE-FB Modules include:

- ❑ **3Com TriChannel Architecture** - The 10BASE-FB Modules operate in an ONline System Concentrator with all ONline modules, including Token Ring and FDDI.
- ❑ **Slot Independence** - You can install modules into any available slot in the ONline Concentrator. This flexibility eliminates the need to shut down the network and rearrange the existing configuration of the concentrator when you install new modules into the concentrator.
- ❑ **“Hot Swap” Capability** - You can install or remove modules from the ONline System Concentrator when it is powered up without affecting the operation of any other modules in the concentrator.
- ❑ **Independent Networks** - You can assign each module to any of three independent Ethernet networks.
- ❑ **Management Support** - You can manage the module through the 3Com ONdemand™ Network Control System. You may also manage the 10BASE-FB modules using terminal management through an ONline network management module.
- ❑ **Compliance** - The 10BASE-FB Modules comply with the IEEE 10BASE-FB fiber standard to provide interoperability with other standards-based products.

10BASE-FB Compliance

The ONline Ethernet Port-Switching 10BASE-FB Modules and the ONline Ethernet 10BASE-FB Module are fully compliant with the IEEE 10BASE-FB fiber standard. The IEEE ratification of the 10BASE-FB standard validates synchronous fiber Ethernet as the choice for backbone links. Synchronous technology provides robust transmission for fiber Ethernet backbones.

Compliance with the 10BASE-FB standard allows 3Com fiber modules to be compatible with:

- ☐ Industry 10BASE-FB-compliant products
- ☐ Existing 3Com 10BASE-FB technology

3Com 10BASE-FB Modules implement Ethernet/IEEE 802.3 physical layer functionality on a fiber optic medium. Full interconnection of all devices that comply with Ethernet V2.0 or IEEE 802.3 specifications are provided, including:

- ☐ Minicomputers
- ☐ Engineering workstations
- ☐ PC networking servers
- ☐ Bridges

Theory of Operation

The 10BASE-FB Modules serve mainly as network backbone links. Network backbone links connect concentrators together. You may also use the 10BASE-FB Modules to connect directly to devices using the:

- ☐ 3Com 5101T-FB Transceiver
- ☐ 3Com 5102T-FBFT Fault-Tolerant Transceiver

Figure 1-1 illustrates a configuration using fiber transceivers and the 10BASE-FB Modules to connect concentrators and devices

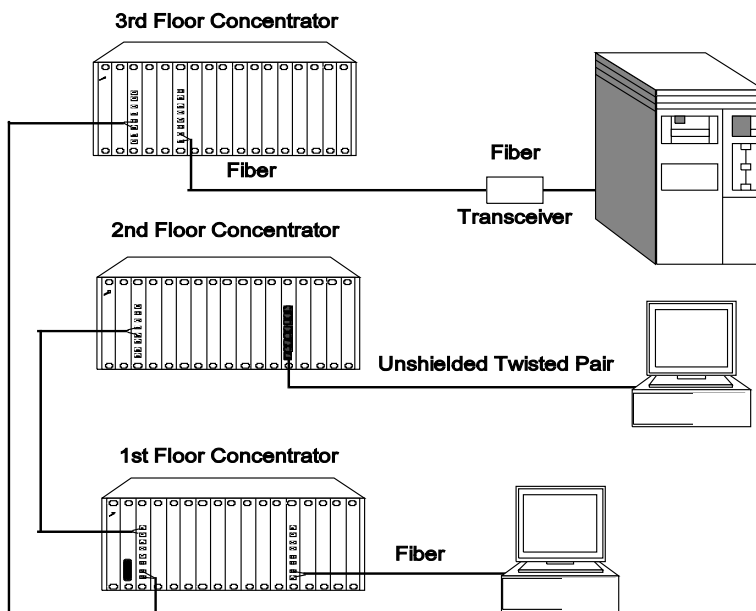


Figure 1-1. 10BASE-FB Module Connections

Compatibility With Other Ethernet Fiber Products

The 10BASE-FB Modules are compatible with the 3Com products outlined in Table 1-1.

Table 1-1. 10BASE-FB Module Compatibility

3Com Product	Part Number
10BASE-FB Star Coupler	9308S-FB
10BASE-FB Transceiver	5101T-FB
Fault-Tolerant 10BASE-FB Transceiver	5102T-FBFT

From the backplane interface, you can also connect the 10BASE-FB Modules to other Ethernet modules on the same network.



Caution: The 10BASE-FB Modules are not compatible with the ONline Ethernet 10BASE-FL Module (Model Number 5104M-FL1). The 4-port 10BASE-FL Module faceplate is similar to the 10BASE-FB Modules, but the two modules cannot communicate.

2 *Designing and Expanding the Network*

This chapter contains configuration information to help you design your network. It describes how to configure networks using the ONline System Concentrator and the ONline 10BASE-FB Modules. It also provides examples of network cabling structures and Ethernet network cabling solutions.

This chapter contains the following sections:

- ❑ Understanding the General Rules
- ❑ Determining Maximum Fiber Link Distances
- ❑ Choosing a Network Backbone Cabling Structure
- ❑ 10BASE-FB Module Configurations
- ❑ Fault-Tolerant Configurations

Note: To ensure proper operation of your network, install all equipment using only approved cables. Refer to Appendix A for information on cable requirements.

Understanding the General Rules

This section describes general rules for configuring an Ethernet network using fiber as the backbone medium. It also provides rules to ensure that your network configuration conforms to distance limitations imposed by Ethernet and networking equipment. Use these guidelines for building your network.

Refer to the sections that follow for specific rules for:

- ❑ Determining maximum 10BASE-FB fiber link distances
- ❑ Connecting various horizontal media types (10BASE-FB, twisted pair) to a 10BASE-FB backbone
- ❑ Examples of recommended fault-tolerant configurations

Rules for Configuring a Network

This section outlines the network rules and recommendations for building an Ethernet network. For more hardware-specific information on the 10BASE-FB, refer to Appendix A.

Table 2-1. Basic Network Rules

Rule	Definition	Recommendations/Notes
1	Use 10BASE-FB as the backbone medium.	Use 62.5 micron cable to conform with the IEEE 10BASE-F and ANSI FDDI standards.
		Use ST-type connectors.
2	Wire the backbone in a star topology to isolate faults.	Lay extra fiber cables. The extra cost is small and you will need them as your network grows.

Table 2-1. Basic Network Rules (Continued)

Rule	Definition	Recommendations/Notes
2 (con't)	Wire the backbone in a star topology to isolate faults.	The star topology conforms to FDDI wiring. Run at least two fiber strands to each backbone connection.
3	Do not exceed the maximum Fiber Ethernet network diameter of 4200 meters of fiber cable.	The 4200 meters is the maximum distance between any two transceivers on the network.
		The 4200 meters <i>does not include</i> the transceiver cable that connects a device with an external transceiver. Transceiver cable can extend up to 50 meters. Thus, total network diameter can be as much as 4300 meters (4200 m + 2 * 50 m) between any two nodes.
4	Certain LAN products on the network shrink the maximum Fiber Ethernet network diameter to less than 4200 meters.	Each microsecond delay through a device on the network shrinks the network diameter by approximately 200 meters of fiber cable. This reduction is known as <i>equivalent distance</i> . Table 2-2 lists the equivalent fiber distances for 3Com ONline LAN products.

Table 2-1. Basic Network Rules (Continued)

Rule	Definition	Recommendations/Notes
5	Assume that one meter of coaxial or twisted pair cable is equal to one meter of fiber cable.	This is a conservative equivalence. One meter of fiber is actually equal to 1.1 meters of coaxial. For simplicity, assume one meter.
6	Verify that the 10BASE-FB link distances do not exceed the limits imposed by the optical power budget.	<p>In general, on 62.5 cable, use up to 4000 meters point-to-point using the 10BASE-FB Modules. If you have poor quality cable or numerous patch panels, you may have to sacrifice some distance.</p> <p>Some older Ethernet fiber optic products are less powerful than ONline 10BASE-FB Module optics. When connecting to these products, remember that they determine the maximum point-to-point distance.</p>
7	When in doubt, use a bridge.	If you are not certain you have exceeded acceptable network distances, use a bridge to extend the network.

Equivalent Fiber Distances

Equivalent fiber distance is the sum of both the incoming and outgoing module port signals. Different products, however, have different equivalent distances. Table 2-2 lists the equivalent fiber distance of 3Com ONline LAN products.

Table 2-2. Equivalent Fiber Distances of LAN Products

LAN Product	Equivalent Fiber Distance (meters)
ONline Ethernet 10BASE-FB Modules (5104M-FB1, 5102M-FBP, 5104M-FBP)	190
Incoming signal to fiber port	140
Outgoing signal from fiber port	50
ONline Ethernet 10BASE-FL Module (5104M-FL1)	560
Incoming signal to fiber port	330
Outgoing signal from fiber port	230
ONline Ethernet 10BASE-T Module (5108M-TP)	585
Incoming signal to TP port	420
Outgoing signal from TP port	165
ONline Ethernet 50-Pin Module (5112M-TPL, 5112M-TPPL)	585
Incoming signal to TP port	420
Outgoing signal from TP port	165
ONline Ethernet 24-Port Module (5124M-TPCL,)	585
Incoming signal to TP port	420
Outgoing signal from TP port	165

Table 2-2. Equivalent Fiber Distances of LAN Products (Continued)

LAN Product	Equivalent Fiber Distance (meters)
ONline Ethernet Repeater Module (5102M-AUIF)	800
Incoming signal to AUI port	600
Outgoing signal from AUI port	200
ONline Ethernet BNC Module (5106M-BNC)	900
Incoming signal to BNC port	450
Outgoing signal from BNC port	450
ONline Ethernet Transceiver Module (5103M-AUIM)	0
3Com 10BASE-FB Star Coupler (9308S-FB)	180
10BASE-FB Star Coupler (9314S)	180
IEEE Repeater	800

Determining Maximum Fiber Link Distances

This section describes how to calculate the maximum allowable link distances between two fiber ports. To do this, you must know the following information:

- ❑ 10BASE-FB optical power budget
- ❑ Fiber cable diameter (for example, 50 micron, 62.5 micron)
- ❑ Fiber cable light loss/km (for example, 3 dB loss/km)
- ❑ Number of patch panel connections and link splices

The following tables assist you in obtaining this information:

- ❑ **Table 2-3** - Lists the optical power budget for the 10BASE-FB Module
- ❑ **Table 2-6** - List typical losses for connector and splice insertion loss
- ❑ **Table 2-7** - Lists typical losses for various fiber cables

Calculating Maximum Link Distance

To calculate the maximum link distance allowed:

1. Determine the optical power budget for the 10BASE-FB port (Table 2-3).
2. Subtract the optical power loss due to patch panels and splices (Table 2-6) from the optical power budget for the 10BASE-FB port.
3. Subtract the dB loss/km rating of the fiber cable (Table 2-7) from the remainder of step 2. If the result is greater than 0, the link distance is valid.
4. If the device connecting to the 10BASE-FB Module does not have the same optical budget as the 10BASE-FB Module, you must also calculate the maximum link distance for the connecting device.

Determining Link Budget

To ensure link integrity, you should plan for worst case losses through the end-to-end optical connection. The optical power budget represents a worst case that assumes the transmitter is transmitting at the low end of its range. When possible, 3Com recommends using Normal power.

Table 2-3 provides the transmit optical power ranges and required receiver optical power budget levels for the 10BASE-FB Modules.

**Table 2-3. *ONline 10BASE-FB Module Optical Power Budget:
Normal Power***

Cable Size Used (micron)	Transmit Power Range (dBm)	Receive Power Range (dBm)	Optical Power Budget (dB)	Link Loss Required (dB) (ONline to ONline)	Link Loss Required (dB) (ONline to 10BASE-FB)
50/125 NA 0.20	-21.5 ± 3.0	-8.0 to -30.0	5.5	None	None
62.5/125 NA 0.275	-17.0±3.0	-8.0 to -30.0	10.0	None	None
85/125 NA 0.29	-14.0 ± 3.0	-8.0 to -30.0	13.0	None	>3.0
100/140 NA 0.29	-11.5±3.0	-8.0 to -30.0	15.5	None	>5.5

Table 2-4 provides 10BASE-FB Module optical power budget values for high power.

Table 2-5 provides information on the 10BASE-FB-specific optical power budget.

**Table 2-4. ONline 10BASE-FB Module Optical Power Budget:
High Power**

Cable Size Used (micron)	Transmit Power (dBm)	Receive Power (dBm)	Optical Power Budget (dB)	Link Loss Required (dB) (ONline to ONline)	Link Loss Required (dB) (ONline to 10BASE-F B)
50/125 NA 0.20	-14.25 \pm 2.25	-8.0 to -30.0	13.5	None	>2.0
62.5/125 NA 0.275	-10.0 \pm 2.25	-8.0 to -30.0	17.75	>0.25	>6.25
85/125 NA 0.29	-7.0 \pm 2.25	-8.0 to -30.0	20.75	>3.25	>9.25
100/140 NA 0.29	-4.5 \pm 2.25	-8.0 to -30.0	23.25	>5.75	>11.75

Table 2-5. 10BASE-FB Optical Power Budget

Cable Size Used (micron)	Transmit Power (dBm)	Receive Power (dBm)	Optical Power Budget (dB)
50/125 (NA 0.20)	-20.0 \pm 1.0	-14.0 to 29.0	8.0
62.5/125(NA 0.275)	-15.1 \pm 1.0	-14.0 to 29.0	12.9
85/125 (NA 0.29)	-13.1 \pm 1.0	-14.0 to 29.0	14.9
100/140 (NA 0.29)	-11.6 \pm 1.0	-14.0 to 29.0	16.4

Attenuation

It is possible for receivers to receive too much light when:

- ☐ Using 85/125 and 100/140 micron fiber cables
- ☐ Ports are close together on a link

Receivers can also receive too much light on 62.5 micron fiber and High power on the 10BASE-FB Modules when:

- ☐ Connecting to an 10BASE-FB product (6.25 dB loss required)
- ☐ Connecting to another 10BASE-FB Module (.25 dB loss required)

In these two situations, switch the 10BASE-FB Module to Normal power.

In all of the cases listed above, some attenuation is required to prevent this problem. This attenuation is covered by:

- ☐ A moderate link length
- ☐ The fiber optic connectors

Splicing

Many fiber optic installations employ the use of patch panels to manage expansion and topological changes. A typical patch panel consists of a set of female to female bulkhead barrel connectors used to connect male fiber connectors on both sides. The optical power loss through a patch panel therefore includes two connectors and a bulkhead.

If a fiber optic cable breaks, the break is usually fixed by splicing the broken ends together. Use one of the following types of splicing methods:

- ☐ **Fusion** – A fusion splice usually offers lower power loss, but the fusion equipment is often bulky and costly.
- ☐ **Mechanical** – A mechanical splice can be conveniently used in the field when a fusion splice is not available. If a repair is made, make sure that the fiber cable still meets the power loss guidelines.

Table 2-6 shows the range of loss and the typical loss as a result of splices.

Table 2-6. Connector and Splice Insertion Loss

Connector Type	Range of Loss Per Pair (dB)	Typical Loss (dB)
SMA Patch Panel	1.0 to 3.0	2.0
ST or FC Patch Panel	0.1 to 0.75	0.5
Splice Type	Range of Loss (dB)	Typical Loss (dB)
Fusion	0.01 to 0.1	0.05
Mechanical	0.2 to 1.0	0.5

Optical Fiber Loss

Even though fiber optic cable can carry light signals over a long distance, optical power loss is a significant factor. Check your cable manufacturer's rating of the loss characteristic of your fiber cable to determine the actual loss.

Table 2-7 shows typical power losses in fiber optic cables.

Table 2-7. Typical Fiber Loss Characteristics

Fiber Type	Loss (dB/km)	Typical Loss (dB/km)
50/125 micron @ 820 nM	3 to 5	3.75
62.5/125 micron @ 820 nM	3 to 5	3.75
85/125 micron @ 820 nM	3 to 6	4.0
100/140 micron @ 820 nM	3 to 6	5.0

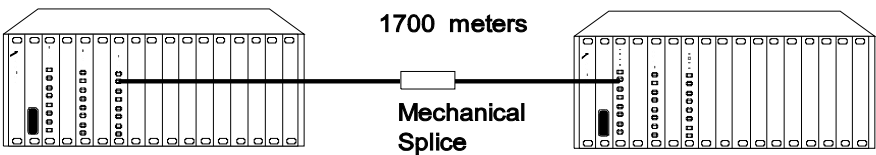
Maximum Link Distance Calculation

The following examples use the information provided in the previous pages to calculate the maximum allowable fiber optic link distance between two ports.

Example: 1700 Meter Fiber Link With Mechanical Splice

In the following example, two ONline concentrators are connected using 10BASE-FB Module ports.

Figure 2-1 shows an example of a 1700 meter fiber link with a mechanical splice using 62.5/125 fiber cable



1.7 km Fiber Cable:	8.5 dB	worst case loss using 5.0 dB/km loss fiber cable
1 Mechanical Splice	1.0 dB	loss worst case
Path Loss =	9.5 dB	

Figure 2-1. 1700 Meter Fiber Link With Mechanical Splice

To calculate the maximum link distance:

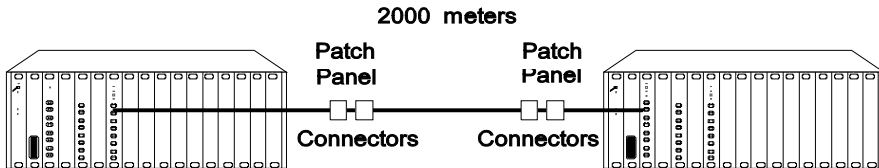
1. Use Table 2-3 to determine the optical power budget for 62.5/125 cable (10.0 dB).
2. Use Table 2-6 to determine the worst case loss for a mechanical splice (1.0 dB).

3. Use Table 2-7 to determine the worst case loss for the 62.5/125 fiber cable (1700 meters x 5 dB = 8.5 dB). Add the losses to determine total path loss. The total path loss is 9.5 dB. Because the overall power budget is 10.0 dB, this leaves .5 dB to spare, so the link can be made.

Ensure you do not overdrive a receiver (that is, the received optical power level is not greater than the maximum received sensitivity level of the fiber connector). In this case, the maximum possible transmit power (-17 dB + 3.0) is -14.0 dB (see Table 2-3). The power loss over the link is 9.5 dB. This means that the power level of the signal will drop to -23.5 dB by the time it reaches the receiver. Because the maximum receiver sensitivity is -8.0 dB, there is no overdrive problem.

Example: 2000 Meter Fiber Link Through Two Patch Panels

In this example, two ONline concentrators are separated by 2000 meters of fiber cable with two patch panels between them



2.0 km Fiber Cable = 10.0 dB loss worst case using 5.0 dB/km loss fiber cable
Two ST Patch Panels = 1.5 dB loss worst case
Path Loss = 11.5 dB

Figure 2-2. 2000 Meter Fiber Link Through Two Patch Panels

To calculate the maximum link distance:

1. Use Table 2-3 to determine the optical power budget for 50/125 cable (5.5 dB).
2. Use Table 2-6 to determine the worst case loss for two ST patch panels (1.5 dB).

3. Use Table 2-7 to determine the worst case loss for the 50/125 fiber cable (2000 meters x 5 dB = 10.0 dB). Add the dB losses to determine total path loss. The total path loss is 11.5 dB.

The 11.5 dB optical loss exceeds the optical power budget of 5.5 dB. Therefore the link will not work and the 10BASE-FB Module Port Status LED will signal a Low Light condition.

Thus, you must use High Power mode. When you use High power (see Table 2-4), the optical power budget of 13.5 dB is sufficient to handle the 11.5 dB path loss.

Choosing a Network Backbone Cabling Structure

Because of fiber's long-distance capabilities and immunity to noise, 3Com strongly recommends using fiber as the backbone. You can choose between two fundamental configuration topologies when connecting your network backbone using 10BASE-FB Modules in an ONline System Concentrator:

- ☐ Star Configuration
- ☐ Serial Configuration

Star Configuration

Wire your network in a star configuration using an ONline System Concentrator as the central point in the network. Wiring in a star topology configuration has two major benefits:

- ❑ Faults in the cable plant affect only a piece of the network
- ❑ You can easily expand the size of your network.

Figure 2-3 shows an example of a Star-wired configuration..

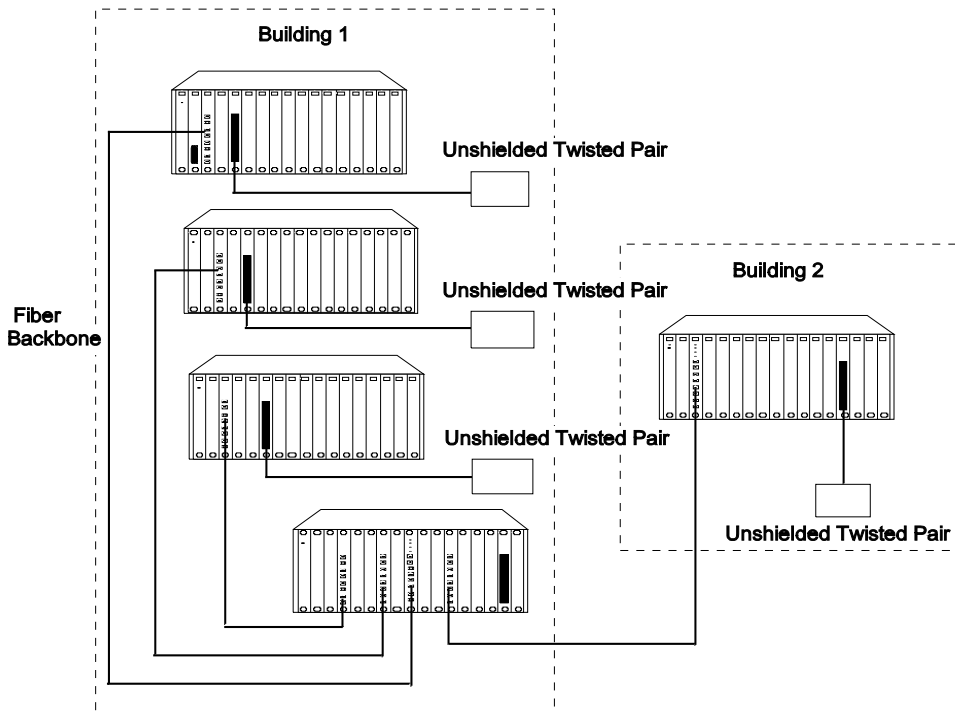


Figure 2-3. Star-Wiring Configuration

Serial Configuration

Use a serial configuration (shown in Figure 2-4) for smaller diameter networks that are not expected to grow. Serial configurations reduce the overall network diameter by 190 meters for each concentrator in any path)

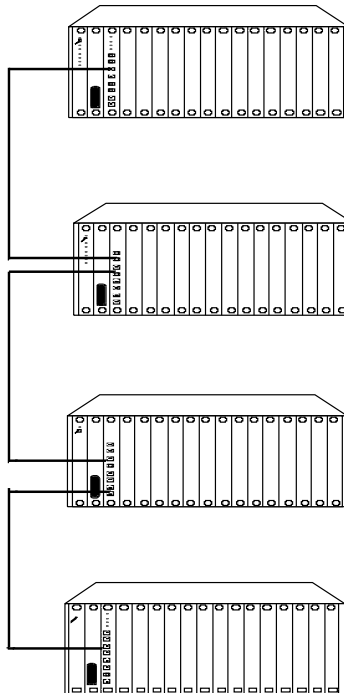


Figure 2-4. Serial Configuration Using 10BASE-FB Modules

10BASE-FB Module Configurations

The theoretical maximum diameter of an all fiber Ethernet network is limited to 4.2 km as defined by the 51.2 μ sec slottime that is specified for the round trip delay budget set by the IEEE 802.3 CSMA/CD protocol. (Thus, point-to-point link distances are limited to a maximum of 4.2 km.) This section describes how to define total network size based on the limits of IEEE 802.3 collision detection.

This section describes the following scenarios:

- ☐ Fiber Backbone, Fiber-to-the-Desk
- ☐ Fiber Backbone, Unshielded Twisted Pair-to-the-Desk
- ☐ Fiber Backbone, Coaxial Connection

Fiber Backbone, Fiber-to-the-Desk

When designing an all-fiber network (Figure 2-5), keep the following rules in mind:

1. Limit the longest path from one fiber optic transceiver to another to 4.2 km (2.6 miles).
2. Each 10BASE-FB Module in a serial path between two transceivers reduces the maximum cable distance between the transceivers by 190 meters (623 feet). The equivalence is:
 - ☐ 140 meters for signals that externally enter a 10BASE-FB Module port
 - ☐ 50 meters for signals that internally enter a 10BASE-FB Module from the concentrator backplane

For simplicity, use 190 meters per 10BASE-FB Module in the path when calculating fiber equivalent distances.

3. AUI cables of up to 50 meters are not included in Rule number 1, thus the total network diameter between fiber Ethernet nodes can be 4110 meters ($4200 \text{ m} - 190 \text{ m} + 50 \text{ m} + 50 \text{ m} = 4110 \text{ m}$) through a single concentrator

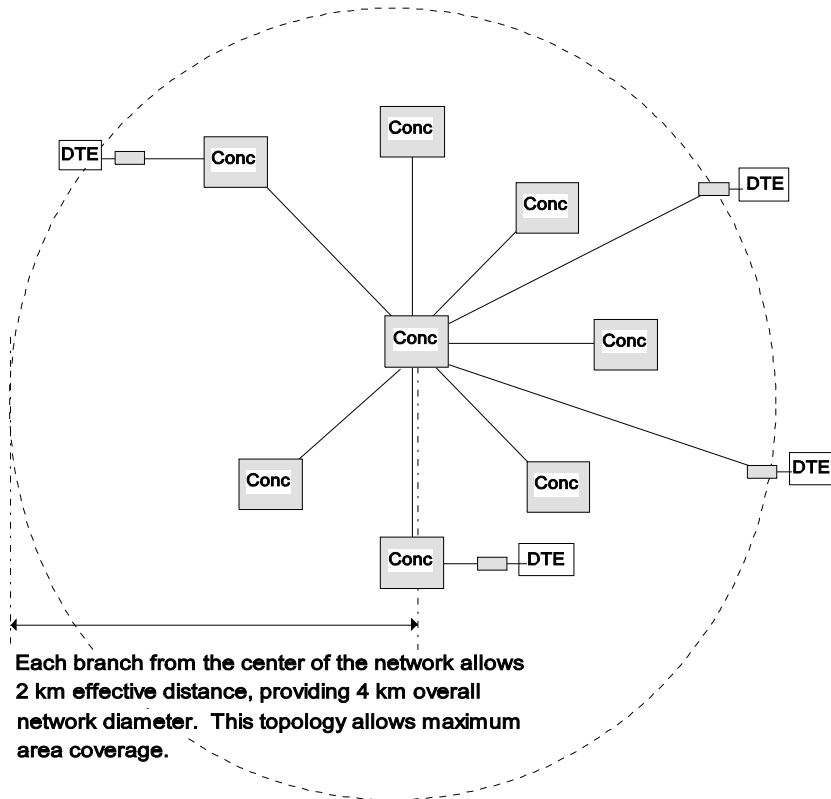


Figure 2-5. All-Fiber Network

The Ethernet four-repeater rule limits the number of repeaters between any two transceivers to four. In general, this restricts most vendor configurations to a maximum of four concentrators connected in series. This restriction *does not* apply to the ONline System Concentrators when using ONline 10BASE-FB Modules to connect concentrators. This is because the 10BASE-FB Modules use a synchronous (repeaterless) technology.

Network Distance Calculation Examples

The following examples demonstrate how to calculate network distances for various all-fiber networks.

Example: Network With 3 Concentrators

Figure 2-6 shows a network with 3 concentrators.

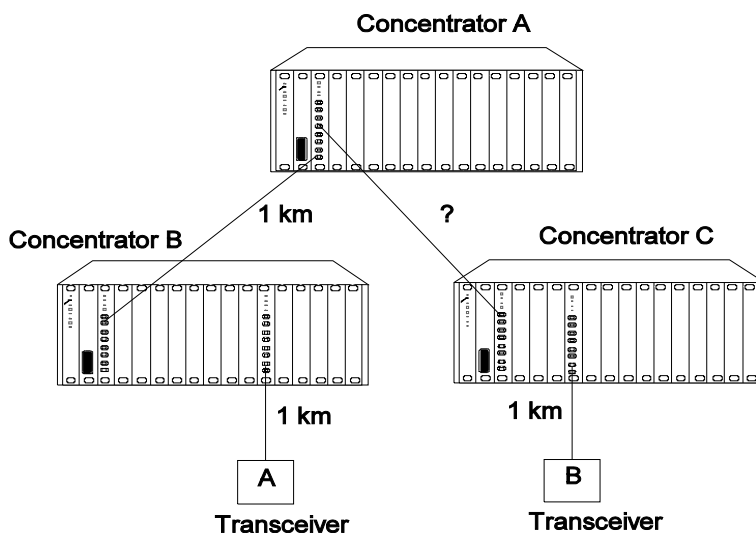


Figure 2-6. Network With 3 Concentrators

To determine the maximum allowable link distance between Concentrators A and C:

1. Use 4200 m as the maximum network diameter for a pure fiber network as defined by the 802.3 specification. (Rule 3).
2. Subtract the fiber equivalent of the three concentrators with 10BASE-FB Modules that occur on the path between the two transceivers:
 $3 * 190 \text{ meters} = 570 \text{ meters}$ (Rule 4)

3. Subtract the known amount of fiber cable between the two transceivers:
 $1 \text{ km} + 1 \text{ km} + 1 \text{ km} = 3 \text{ km}$ (Rule 5)
4. The remainder is the maximum allowable distance of the link between Concentrators A and C:
 $4200 \text{ m} - 570 \text{ m} - 3000 \text{ m} = 630 \text{ meters}$
5. Verify that the optical power budget is able to drive all the link distances in the example. Because all link distances are only 1 km or less, this is not a problem.

Example: Network with 8 Concentrators

Figure 2-7 shows a network with eight connected concentrators. Use this example to determine if the distances between transceivers are all within the 4200 meter maximum network diameter restriction for Ethernet networks.

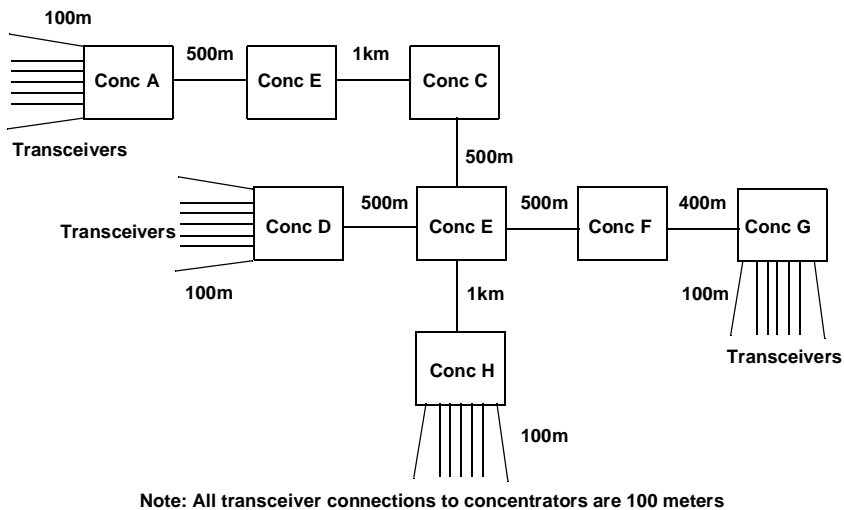


Figure 2-7. Network Configured With 8 Concentrators

In this example, the path between transceivers attached to Concentrators A and G has the greatest fiber equivalent distance (4240 meters), even though the link distance is less than the A to H path (3100 meters versus 3200 meters). Because 4240 meters exceeds the 4200 meter maximum, this configuration is illegal and results in improper network operation.

Because it is not always obvious which path between transceivers has the highest fiber equivalent distance, use Table 2-8 to help you determine the equivalent distances.

Table 2-8. Fiber Equivalent Distances Between Transceivers

Path	Total Fiber Link Distance Between Transceivers (meters)	Number of Concentrators Between Transceivers	Equivalent Fiber Distance of Concentrators (meters)	Total Fiber Equivalent Distance (meters)
A - D	2700	5	950	3650
A - H	3200	5	950	4150
A - G	3100	6	1140	4240
D - H	1700	3	570	2270
D - G	1600	4	760	2360
G - H	2100	4	760	2860

Fiber Backbone, Unshielded Twisted Pair to-the-Desk

Configuring a network with unshielded twisted pair cabling to-the-desk is similar to an all-fiber network because the cabling is star-wired in both cases.

Be aware of the following additional rules for configuring a network:

- ❑ The four-repeater rule in Ethernet limits the number of 10BASE-T modules between any two transceivers. The path from the TP port to the backplane counts as 1/2 of a repeater and the path from the backplane to the TP port counts as 1/2 of a repeater. You must add a bridge if the path from one transceiver to another exceeds the four-repeater rule.
- ❑ The equivalent fiber distance for the 10BASE-T Modules is defined in “Understanding Network Configuration” in this chapter:
 - 420 meters for signals that externally enter a 10BASE-T Module port
 - 165 meters for signals that internally enter a 10BASE-T Module through the ONline concentrator backplane

For each pair of 10BASE-T Modules that a signal goes through, there is a fiber equivalent distance of 585 meters ($420\text{ m} + 165\text{ m} = 585\text{ m}$). In addition, if a signal makes a roundtrip through a 10BASE-T Module, (that is, enters a 10BASE-T port externally and exits through another port on the same 10BASE-T Module) that counts as 585 meters of fiber equivalent distance, and as a full repeater.

Example: Sample Configuration Distance Calculation

Use the following example to determine if the 10BASE-T Transceivers in Figure are within legal Ethernet limits. Identify the two transceivers that are likely to be the greatest fiber equivalent apart in Figure 2-8. In this case, they are 10BASE-T Transceivers A and B.

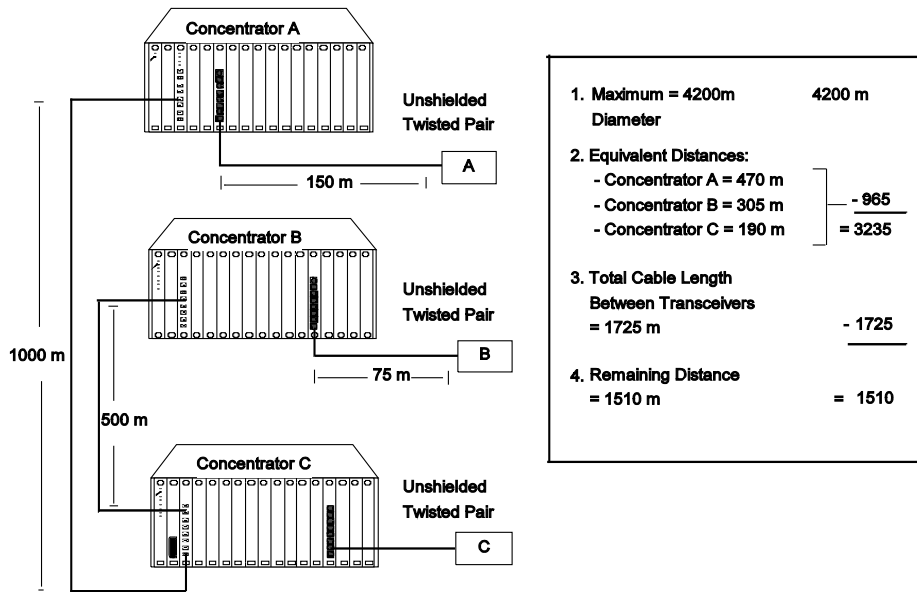


Figure 2-8. Sample Configuration Distance Calculation

To determine if your network configuration is legal:

1. Use 4200 m as the maximum network diameter for a pure fiber network as defined by the 802.3 specification.
2. Calculate the equivalent distances for each concentrator, and subtract the total from 4200 (see figures for details).
3. Subtract all cable lengths between the two transceivers and if the result is greater than zero, the configuration is within legal Ethernet limits (Rule 5).

For the configuration shown in Figure 2-8 to work, ensure the fiber equivalent distance between Transceiver A and Transceiver B is less than 4200 meters. As shown in the calculation, there are still 1510 meters left for expansion in this configuration. Therefore, this configuration is legal.

Fiber Backbone, Coaxial Connection

When connecting Thick or Thin Ethernet segments to an ONLINE network, use an:

- ☐ ONLINE Ethernet Bridge Module
- ☐ ONLINE Ethernet Repeater Module
- ☐ External bridge or repeater

If you use a repeater or the ONLINE Ethernet Repeater Module, remember that these products have an equivalent fiber distance of 800 meters.

Example: Connecting a Thin Ethernet (10BASE2) Segment

Figure 2-9 shows an example of a Thin Ethernet segment connected to an ONLINE System Concentrator using an IEEE Repeater

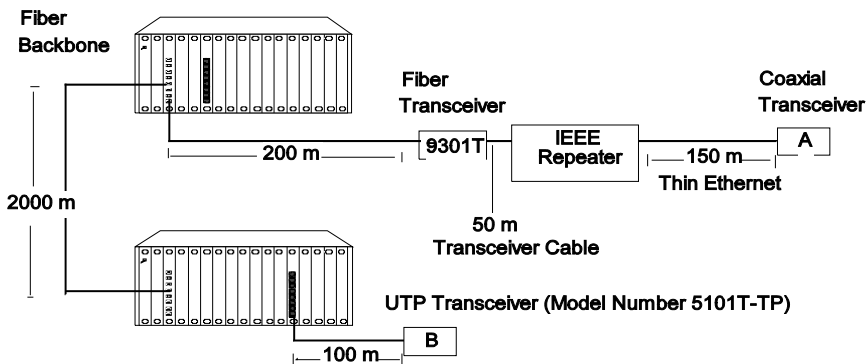


Figure 2-9. Thin Ethernet Segment Connected to an ONLINE 10BASE-FB Module

To determine if the configuration meets Ethernet distance limitations for Transceivers A and B:

1. Use 4200 m as the maximum network diameter for a pure fiber network as defined by the 802.3 specification (Rule 3).
2. Subtract the fiber equivalent distance of 420 m for the signal entering the 10BASE-T Module from Transceiver B and 50 meters for the signal exiting the 10BASE-FB Module within the same concentrator (Rule 4).
3. Subtract the fiber equivalent distance of 190 m for the signal entering the 10BASE-FB Module in the top concentrator, and exiting a different port on the same 10BASE-FB Module.
4. Subtract the fiber equivalent distance (800 m) of the IEEE Repeater (Rule 4).

Note: In the reverse direction, a signal originating at Transceiver A loses 165 m of fiber equivalent distance when it exits the 10BASE-T Module to which Transceiver B is connected and 140 meters for the signal entering the 10BASE-FB Module in the lower concentrator. Because the overall fiber equivalence of the path is greater for signals going from Transceiver B to A, the fiber equivalence of this path determines whether the link meets the 4200 m Ethernet link maximum.

5. Subtract the sum of intervening cable lengths:
 $150\text{ m} + 50\text{ m} + 200\text{ m} + 2000\text{ m} + 100\text{ m} = 2500\text{ m}$
6. The remainder is $4200\text{ m} - 420\text{ m} - 50\text{ m} - 190\text{ m} - 800\text{ m} - 2500\text{ m} = 240\text{ m}$.

Fault-Tolerant Configurations

This section contains descriptions of the redundancy features built into the ONline 10BASE-FB Modules. You can implement link redundancy between concentrators using the port redundancy switch settings on the 10BASE-FB Modules or through ONline network management.

This section contains the following topics:

- ❑ Configuring Ports for Fault Tolerance
- ❑ Implementing Total Backbone Fault Tolerance

Configuring Ports for Fault Tolerance

You can configure the 10BASE-FB Module ports in one of four different ways:

- ❑ **Normal Configuration** – Ports 1 through 4 operate as independent cable ports.
- ❑ **Standard Redundant Configuration** – In this configuration:
 - Port 1 acts as the primary port and port 2 as the backup for 1
 - Port 3 acts as the primary port and port 4 as the backup for 3
- ❑ **Flexible Redundant Configuration** – You can arbitrarily assign primary and backup ports to any pair of ports. You can configure this mode only through the advanced management commands provided with EMM V3.0 or greater.
- ❑ **Normal and Redundant Configuration** – You can enable redundancy between one set of ports and have the remaining two ports operate as independent ports.

Setting Redundancy

When you enable redundancy between two ports, the ports are automatically enabled.

- ❑ Port 1 (or 3) as the primary link, which passes data.
- ❑ Port 2 (or 4) as the redundant link, which does not pass data in either direction. However, the link is monitored for any failures (the Port Status LED indicates any problems).

For maximum cable plant fault tolerance, connect both the primary and backup ports back to the central concentrator (Figure 2-10). This configuration allows the backup port to automatically take over if the primary link fails

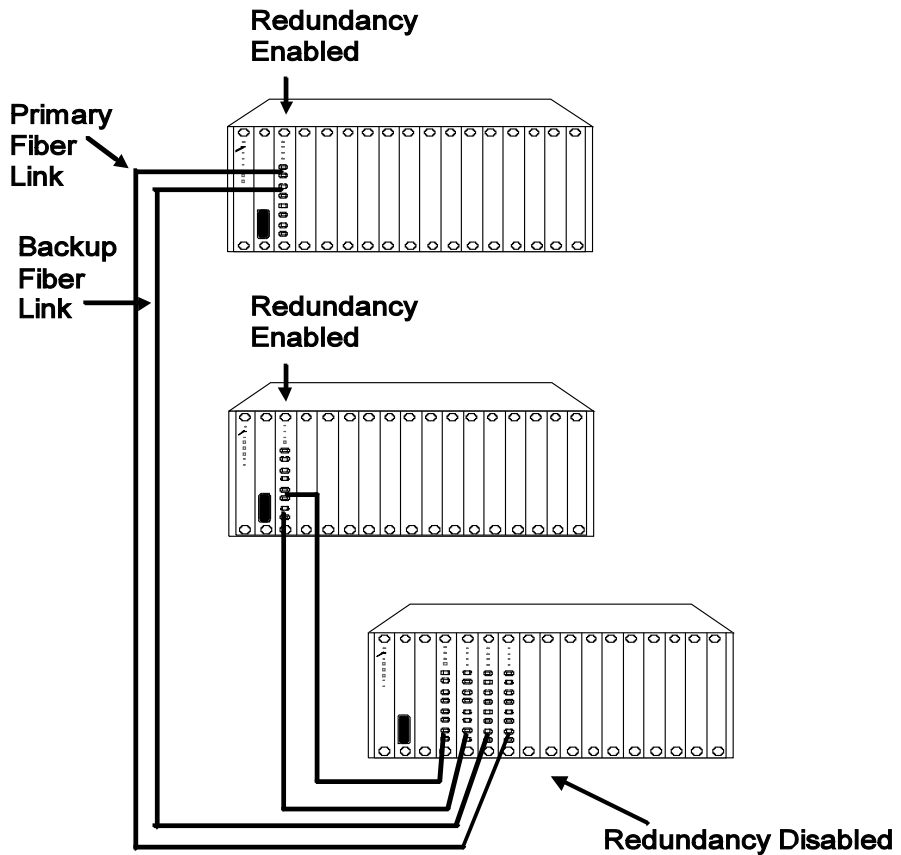


Figure 2-10. Redundant Fiber Backbone Configuration

Note: Always enable redundancy in the lower level concentrators (those connecting to the central concentrators in the star-wired topology).

In any redundant link path, only one end can be designated (that is, activated) as a redundant port pair (ports 1 and 2 or ports 3 and 4). If you enable 10BASE-FB Module ports at both ends as redundant, improper operation of the redundant switchover mechanism occurs (see Figure 2-11).

If the primary link experiences a local or remote fault (except Low Light):

- ❑ The backup link activates within 10 milliseconds
- ❑ The primary ports disconnect (that is, they do not pass data to and from the concentrator)

However, primary port diagnostics continue to operate. When the fault clears, the primary port is enabled automatically. Once a switchover occurs, the redundancy status indicators blink.

Each redundancy status LED (located beneath the Activity LEDs):

- ❑ **Is off** - If you disable redundancy
- ❑ **Is on** - If you enable redundancy and both ports are operational
- ❑ **Blinks** - If a switchover occurs due to a link failure

Implementing Total Backbone Fault Tolerance

You can add a backup ONline System Concentrator to provide total backbone tolerance and link redundancy for your backbone network. As shown in Figure 2-11, if the primary concentrator or any primary links fail, the backup concentrator takes over. In this configuration:

- ❑ One port on the 10BASE-FB Module connects to the primary concentrator
- ❑ The other port connects to the backup concentrator

You must also have a direct connection between the two concentrators.

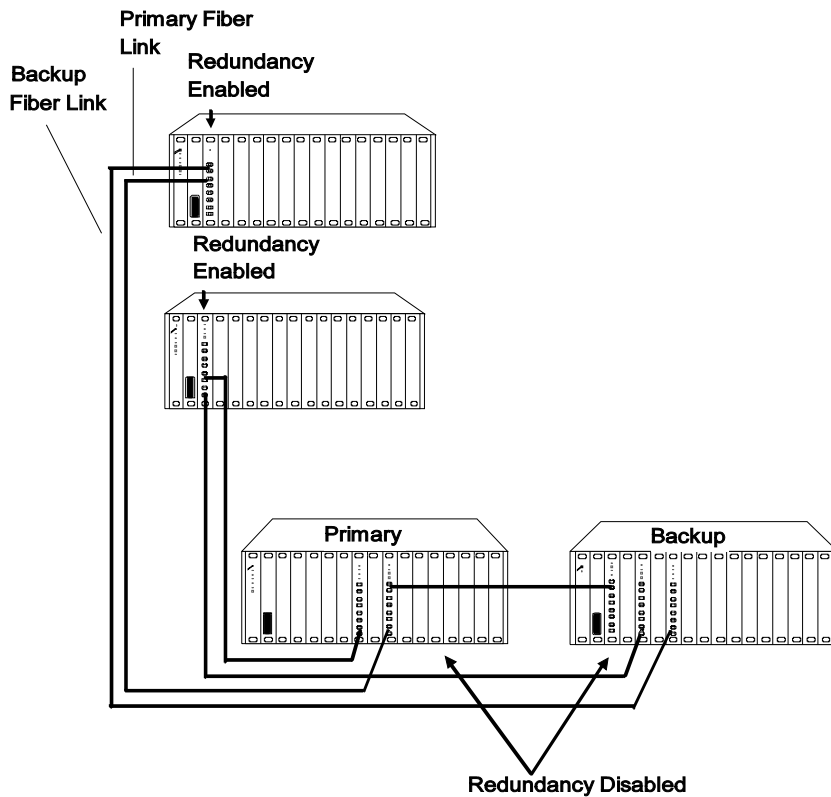


Figure 2-11. Total Backbone Fault-Tolerant Configuration

Example: Fiber Network with 3 Concentrators and a Fourth Concentrator in Full Redundancy Configuration

In Figure 2-12, three concentrators are active where Concentrator B is a redundant concentrator for Concentrator A.

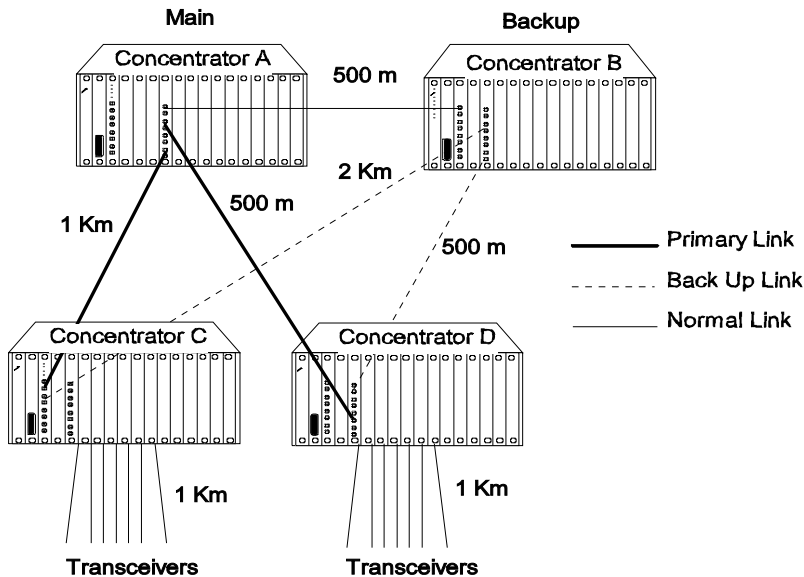


Figure 2-12. Fiber Network With 3 Concentrators

In Figure 2-12, the fiber equivalent distance between transceivers attached to Concentrators C and D is:

$$3 * 190 \text{ m} + 1000 \text{ m} + 1000 \text{ m} + 500 \text{ m} + 1000 \text{ m} = 4070 \text{ m}$$

Because this is less than 4200 meters, the configuration is legal.

In Figure 2-12, if the main link from Concentrator A to Concentrator C faults, the signal path (enabled through redundancy) includes Concentrator B. By adding Concentrator B, the fiber equivalent distance has become too great and the network cannot work because the path between Concentrators C and D is C-B-A-D:

$$4 * 190 + 1000 \text{ m} + 2000 \text{ m} + 500 \text{ m} + 500 \text{ m} + 1000 \text{ m} = 5760 \text{ m}$$

Because the sum is greater than 4200 meters, this configuration is not legal. When designing a redundant network, be sure to consider the backup route distance.

3 *Installing and Operating the Module*

This chapter describes the installation procedures for the:

- ❑ ONline Ethernet Port-Switching 10BASE-FB Module
- ❑ ONline Ethernet 10BASE-FB Module

For your convenience, a quick reference installation chart is included. This chapter includes the following sections:

- ❑ Precautionary Procedures
- ❑ Unpacking Procedures
- ❑ Quick Installation
- ❑ Setting the Dip Switches
- ❑ Installing the Module
- ❑ Configuring the Module
- ❑ Showing Module Configuration
- ❑ Monitoring the Front Panel
- ❑ Verifying the LEDs and Network Assignments

Note: Read the precautionary procedures before unpacking the module.

Precautionary Procedures

Electrostatic discharge (ESD) can damage static-sensitive devices on circuit boards. Follow these precautions when you handle the 10BASE-FB Modules:

- ❑ Do not remove the board from its anti-static shielding bag until you are ready to inspect it.
- ❑ Handle the board by the faceplate.
- ❑ Use proper grounding techniques when you install a 10BASE-FB Module. These techniques include:
 - Using a foot strap and grounded mat or wearing a grounded static discharge wrist strap.
 - Touching the grounded rack or other source of ground just before you handle a 10BASE-FB Module.

Unpacking Procedures

When unpacking your 10BASE-FB Module:

1. Verify that the 10BASE-FB Module is the correct model by matching the model number listed on the side of the shipping carton to the model number you ordered (Model Numbers 5102M-FBP, 5104M-FBP, or 5104M-FB1).

Note that the product model number printed on the shipping box differs from the model number on the product. The model number on the shipping box contains the prefix '3C9'.

2. Remove the module from the shipping carton.
3. Remove the module from the anti-static shielding bag and inspect it for damage. If the module appears to be damaged, replace it in the anti-static shielding bag, return it to the shipping carton, and contact your local supplier.
4. Keep the shipping carton and anti-static shielding bag in which your module was shipped for repackaging the module for storage or shipment.
5. Record the serial number of your 10BASE-FB Module. A log for this and other information specific to your modules is included in the *ONline SystemConcentrator Installation and Operation Guide*, Appendix B, Slot Usage Chart.

Quick Installation

Table 3-1 outlines the steps for installing your 10BASE-FB Module.

Table 3-1. Quick Installation Procedures

Step	Procedure	Section Title
1	Verify that your network complies with the basic rules for network design.	Chapter 2, <i>Designing and Expanding the Network</i>
2	Unpack the module.	<i>Unpacking Procedures</i>
3	If you <i>do not</i> have a management module installed in the concentrator, configure the dip switch settings to your specifications.	<i>Setting the Dip Switches</i>
4	Insert the module into a blank slot in the concentrator and tighten the faceplate screws.	<i>Installing the Module</i>
5	Establish connections from the 10BASE-FB Module to another 10BASE-FB Module or 10BASE-FB Transceiver using the appropriate connectors and cabling.	<i>Installing the Module</i>
6	If you have a management module installed in the concentrator, configure the module using the management commands.	<i>Configuring the Module</i>
7	Verify LED status for normal operation. Note: To correct problems, consult the troubleshooting techniques in Chapter 4.	<i>Verifying LED and Network Assignments</i>

Setting the Dip Switches

The 10BASE-FB Modules have two 10-position dip switches (S1 and S2) located on the board. Figure 3-1 shows the dip switches on the 10BASE-FB Modules and the factory settings.

- ❑ Dip switch S1 on the Port-Switching Module differs from dip switch S1 on the Module-Switching Module. Figure 3-1 contains examples of both dip switches.
- ❑ Dip switch S2 is identical for both the Port-Switching Module and Module-Switching Module except the Module-Switching Module does not provide High power optics.

You may need to reconfigure one or more of these switches depending on your configuration requirements.

The dip switch settings for the 10BASE-FB Modules are ignored if an ONline management module is installed in the concentrator. For this reason, use the management commands (rather than the dip switches) to configure the 10BASE-FB Modules. If you have an installed management module, install the 10BASE-FB Module first and then refer to the Configuring the Module section in this chapter for more information.

This section describes:

- ❑ Setting Dip Switch S1
- ❑ Setting Dip Switch S2

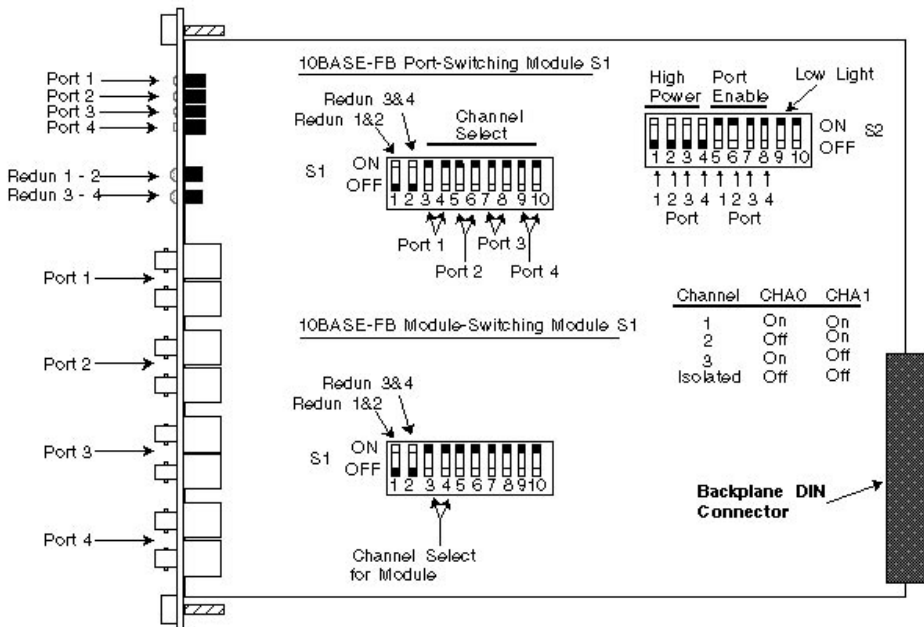


Figure 3-1. 10BASE-FB Module Dip Switch Locations

Note: The Port-Switching 10BASE-FB Module is also available as a two-port module (Model Number 5102M-FBP) for installations that do not require four fiber ports. When using the switches for the two-port module, all switches operate identical to the switches on the four-port module with the exception of port 3 and port 4 switches. These switches do not perform any operation.

Setting Dip Switch S1

The S1 dip switch on the 10BASE-FB Modules have 10 switches. These switches allow you to enable or disable redundancy between ports 1 & 2 and 3 & 4.

The S1 dip switch on the:

- ☐ Port-Switching 10BASE-FB Module allows you to - assign each port to a backplane channel
- ☐ Module-Switching 10BASE-FB Module allows you to - assign the module to a backplane channel

For a definition of each dip switch function, refer to the Configuring the Module section.

Table 3-2 lists the functions and settings for switches 1 and 2.

Table 3-2. Dip Switch S1 Settings for Switches 1 and 2

Switch	Label	Function	Factory Default	Switch Setting	
				Off	On
1	REDN12	Enable/disable redundancy between ports 1 and 2	disable	disable	enable
2	REDN34	Enable/disable redundancy between ports 3 and 4	disable	disable	enable

Table 3-3 lists the functions and settings for switches 3 through 10.

Table 3-3. Dip Switch S1 Settings for Switches 3 to 10

	CHA0	CHA1	Channel Selection
Switch Setting	On	On	1 (factory default)
	Off	On	2
	On	Off	3
	Off	Off	Isolated Port-Switching Module: Port operates independent of any backplane channel. Module-Switching Module: Module operates independent of any backplane channel.

Setting Dip Switch S2

Dip switch S2 on the 10BASE-FB Modules have 10 switches. These switches allow you to:

- ☐ Enable high or normal optical power for each port
- ☐ Enable or disable any of the four ports
- ☐ Enable or disable low light detection for the module

Table 3-4 lists the functions and settings for dip switch S2. Switch 10 is not used.

Table 3-4. Dip Switch S2 Settings

Switch	Label	Function	Factory Default	Switch Setting Off On	
1	P1 HIPWR	Port 1 High or Normal power	disable (normal)	disable	enable
2	P2 HIPWR	Port 2 High or Normal power	disable (normal)	disable	enable
3	P3 HIPWR	Port 3 High or Normal power	disable (normal)	disable	enable
4	P4 HIPWR	Port 4 High or Normal power	disable (normal)	disable	enable
5	P1 EN	Enable/disable Port 1	enable	disable	enable
6	P2 EN	Enable/disable Port 2	enable	disable	enable
7	P3 EN	Enable/disable Port 3	enable	disable	enable
8	P4 EN	Enable/disable Port 4	enable	disable	enable

Table 3-4. Dip Switch S2 Settings (Continued)

Switch	Label	Function	Factory Default	Switch Setting	
				Off	On
9	LOL EN	Enable/disable module Low Light Detection	enable	disable	enable
10	Not Used				

Installing the Module

You do not need to power down the ONline System Concentrator to install the 10BASE-FB Modules. You can insert or remove the module while the concentrator is operating (this is called a *hot swap*).

To install a 10BASE-FB Module:

1. Do one of the following:
 - ☐ If you do not have a management module installed in the concentrator, set the dip switches on the board (if different from the default setting). After you complete the installation procedure, go to the Monitoring the Front Panel section to verify the installation.
 - ☐ If you have a management module installed in the concentrator, complete this installation procedure and then configure the module using the commands as described in the Configuring the Module section.
2. Locate a blank slot in the concentrator. If there is no blank slot, remove a blank panel on the concentrator to expose a slot for a 10BASE-FB Module.

3. Insert the module into the board guides at the top and bottom of the slot and slide it into the concentrator. Make sure that the connector is well-seated into the backplane of the concentrator.

Figure 3-2 shows the installation of a 10BASE-FB Module

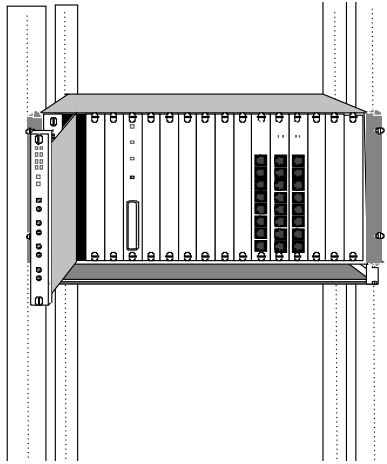


Figure 3-2. Installing the 10BASE-FB Module

4. Fasten the spring-loaded screws on the front of the 10BASE-FB Module faceplate to the concentrator using your fingers (do not overtighten).
5. Remove the plastic fiber optic covers from the cable ports. Keep unused cable ports capped to keep the optics clean.
6. Attach the fiber cables to the fiber ports on the front of the 10BASE-FB Module as shown in Figure 3-3.

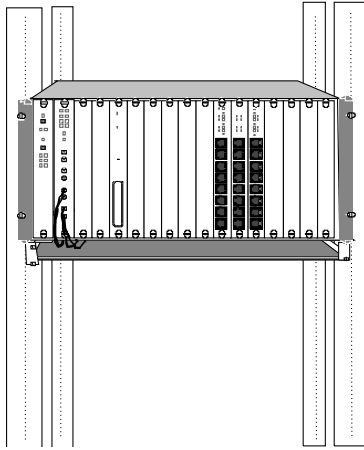


Figure 3-3. 10BASE-FB Module Connection

7. Make sure transmit and receive cables are:

- ☐ Clearly marked or color-coded.
- ☐ Connected to the appropriate ports on the 10BASE-FB Module.
- ☐ Properly cleaned with an appropriate fiber optic cleaning solution before installation.

Note: Do not exceed the bend radius for the fiber cable when directing the cables under the concentrator. Refer to the cable manufacturer's specifications for minimum bend radius.

8. Attach the other ends of the cables to either:

- ☐ Another 10BASE-FB module
- ☐ 3Com 10BASE-FB Star Coupler port
- ☐ 3Com 10BASE-FB Transceiver

- ❑ 3Com Fault-Tolerant 10BASE-FB Transceiver

Make sure that the transmit fiber at one end always connects to a receive port at the other end.



Caution: Do not connect this module to an ONLINE 10BASE-FL Module or to any other product that is not compatible with the 10BASE-FB modules. These illegal connections may cause network failure.

Configuring the Module

The ONLINE management modules can configure the following settings on the 10BASE-FB Modules:

- ❑ Enable and disable each port on the module
- ❑ Set the ports to independent Ethernet networks within the concentrator (Port-Switching 10BASE-FB Module)
- ❑ Set the module to independent Ethernet networks within the concentrator (10BASE-FB Module)
- ❑ Set redundancy between two ports on the module *or* between ports on another 10BASE-FB Module (using Advanced EMM V4.01 or higher)
- ❑ Enable and disable the low light warning
- ❑ Set the fiber optic transmission power for each port

The following ONLINE management modules provide network management capabilities for the ONLINE System Concentrator and its modules:

- ❑ Ethernet Management Module V4.01
- ❑ Token Ring Management Module V3.10
- ❑ FDDI Management Module V2.00

When an ONline management module is installed in a concentrator, all of the dip switch settings on the 10BASE-FL Module are overridden.

When you first install the module:

1. The network (channel) defaults to isolated mode. The ports are automatically disabled so that unapproved users cannot be added. Therefore, you must enable the ports you wish to use and set the ports to the appropriate Ethernet network through the management commands.
2. All other module settings retain the same default values as the dip switch default values. Therefore, you only need to changes these values through management if you do not want the default values.

This section describes the management commands to set these features. For additional information on the available network management features, refer to:

- ❑ The appropriate ONline management module installation and operation guide
- ❑ *ONline Management Commands Guide*

Enabling Ports

You can enable or disable each of the four ports on the module. When a port is enabled, it can transmit data onto and receive data from the network to which the module is assigned. Disable all unused ports on the 10BASE-FB Modules to prevent the Status indicators from flashing a No Light condition.

To enable or disable a specific port, use the following management command:

```
SET PORT    {slot.port} MODE    {enable}  
           {slot.all}   {disable}
```

Selecting a Network

Both models of the Port-Switching Module (Model Numbers 5102M-FBP or 5104M-FBP) support Port-Switching technology. This feature enables you to assign each port on the module to any of three Ethernet networks (or isolated) on the ONline System Concentrator backplane.

To set a port to a network or to isolated mode, use the following management command:

```
SET PORT  {slot.port} NETWORK {ethernet_1}
          {slot.all}   {ethernet_2}
                      {ethernet_3}
                      {isolated}
```

The 10BASE-FB Module (Model Number 5104M-FB) enables you to assign the module to any of the three Ethernet networks (or isolated) on the ONline System Concentrator backplane.

To set a module to a network or to isolated mode, use the following management command:

```
SET MODULE {slot} NETWORK {ethernet_1}
                        {ethernet_2}
                        {ethernet_3}
                        {isolated}
```

Note: The dip switch settings on the module refer to the backplane connection as the “channel” connection. The channel setting and the network setting are the same. Modules or ports set to the same network communicate with each other.

Enabling Port Redundancy

You can enable port redundancy in one of the following ways:

- ❑ If you have network management, you can enable or disable main port redundancy between any two ports on the 10BASE-FB Module.
- ❑ If you do not have management, you can use the dip switches on the module to configure redundancy between ports 1 and 2 on the module or ports 3 and 4.

For example, when you enable redundancy:

1. Port 1 becomes the primary link and port 2 is the redundant link.
2. If the primary link (port 1) fails, the redundant link (port 2) is engaged automatically, thus preventing a network failure.
3. When you disable redundancy, each port works independently.

Note: Enabling port redundancy for two ports automatically enables the ports, even if the ports were previously disabled.

The redundancy status LEDs, located between the sets of port LEDs and the port connectors on the 10BASE-FB Module, are:

- ❑ **Off** - When you disable redundancy (default setting)
- ❑ **On** - When you enable redundancy

To set redundancy between ports, use the following management command:

```
SET PORT {slot.port} MODE REDUNDANT {slot.port}
```

To turn off redundancy between ports, use the MODE NON_REDUNDANT option. Redundancy configurations are shown in Chapter 2, Designing and Expanding the Network.

When you set redundancy between two ports on the same 10BASE-FB Module and the primary port and the redundant port experience a link failure simultaneously, and you disable redundancy:

- ❑ The primary port is disabled
- ❑ The redundant port is enabled

Enabling Low Light Warning

You can enable or disable low light warning for all ports on the module. When you enable low light warning, the Status LED of the port which detects the low light condition blinks 6 times. (A low light condition is defined as power received between -26.0 dBm and -30.0 dBm peak power.)

You may have a legal configuration in which low light is acceptable to span a long distance. In this case, you may want to disable the low light warning so the Status LED does not blink for this connection.

To enable or disable low light warning for a port, use the following management command:

```
SET PORT {slot.port} LOW_LIGHT_WARNING {enable}  
        {slot.all}                {disable}
```

Enabling Optical Power

High-power optics are standard in all 3Com ONline fiber optic products. The higher power allows you to directly connect buildings as far as 4.0 kilometers apart without the additional expense of signal-boosting equipment. However, it is necessary to set a port to the normal power setting when it is connected to a 3Com 10BASE-FB fiber optic product.

Each port on the Port-Switching 10BASE-FB module can be set to high or normal power through the dip switches or through management commands. To set a port to high or normal power, use the following management command:

```
SET PORT {slot.port} HIGH_POWER {enable}  
        {slot.all}                {disable}
```

The 10BASE-FB Module-Switching Module can be set to high or normal power through the dip switches (see Table 3-4).

Saving Module Configuration

To save the module and port settings to management module memory, use the following command:

```
SAVE MODULE_PORT
```

Showing Module Configuration

You can display status information about the 10BASE-FB Modules using the following commands:

- ☐ SHOW MODULE
- ☐ SHOW MODULE VERBOSE
- ☐ SHOW PORT
- ☐ SHOW PORT VERBOSE

For example, the following command displays detailed information about port 1 on the Port-Switching 10BASE-FB Module in slot 8 of the concentrator.

```
ONline> show port 8.1 verbose          [ENTER]
Port Display for Module 5104M-FBP:
Port      Mode      Status      Network      General Information
-----
08.01    ENABLED    OKAY        ETHERNET_2
Network Dip Setting:    ETHERNET_2
Mode Dip Setting:       ENABLED
Low Light Warning:      ENABLED
Low Light Warning Dip Setting:  ENABLED
High Power Optics:      ENABLED
High Power Optics Dip Setting:  DISABLED
```

This display tells you the status of the specific port. It includes the management and dip switch settings from the board.

The following command displays detailed information about the 10BASE-FB Module in slot 8 of the concentrator.

```
ONline> show module 8 verbose          [ENTER]
Port Display for Module 5104M-FB1:
Slot   Module      Version   Network   General Information
08      5104M-FB1    00x      ISOLATED   ETHERNET_2
5104M-FB1: Online Ethernet 10BASE-FB Module
Network Dip Setting:          ETHERNET_1
Low Light Warning:           DISABLED
Low Light Warning Dip Setting: DISABLED
```

This display tells you the status of the specific module. It includes the management and dip switch settings from the board.

For more information on the SHOW commands, refer to the:

- ❑ Appropriate ONline management module installation and operation guide
- ❑ *ONline Management Commands Guide*

Monitoring the Front Panel

The LEDs on the front panel of the 10BASE-FB Module allow you to monitor the status of each port. The 10BASE-FB Module has 10 LEDs on the front panel that allow you to monitor diagnostic, activity, and redundancy status for each port. Figure 3-4 shows the locations of these indicators.

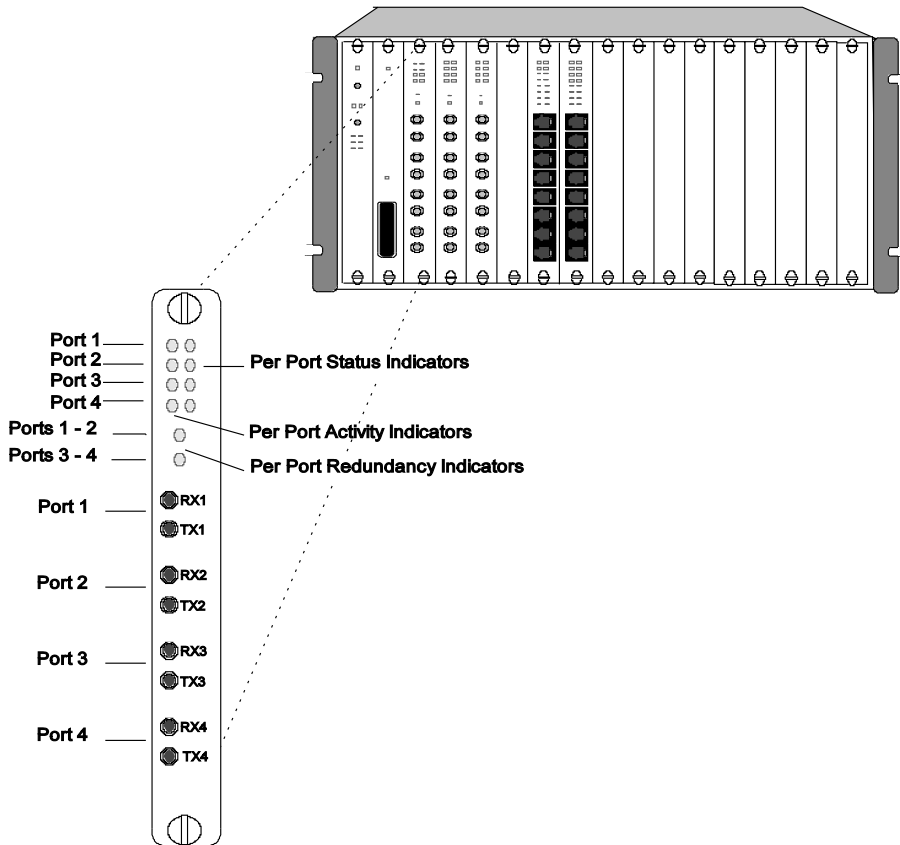


Figure 3-4. 10BASE-FB Port-Switching Module Faceplate and Online System Concentrator

Table 3-5 describes how to interpret the 10BASE-FB Module LEDs.

Table 3-5. Interpreting the 10BASE-FB Module LEDs

LED Name	Color	State	Indicates
Activity (Ports 1-4)	yellow	Off	No packets are received on the fiber segment.
		On	Constant activity on the fiber segment.
		Blinking	Module receives packets from segment to which it is attached.
Status (Ports 1-4)	green	Off	Port disabled.
		On	Port enabled or in standby and link integrity is OK.
		1 blink	No light detected.
		2 blinks	Jabber.
		3 blinks	Partition.
		4 blinks	Remote fault.
		5 blinks	Invalid data received.
		6 blinks	Low light received (you can disable it using Low Light switch setting).
Redundancy (Ports 1-2) (Ports 3-4)	green	Off	Redundancy is disabled; ports are independent of each other.
		On	Redundancy is enabled between ports 1 & 2 and 3 & 4.
		Blinking	Switchover has taken place or there has been a link failure.

Verifying LED and Network Assignments

Once you install the module, verify its operation through the front panel of the ONline Controller Module. The Controller Module is equipped with an LED check button on the front panel. Use the LED check button to:

- ❑ Verify LED operation
- ❑ Verify network (channel) assignment

When you press this button, the Controller Module initiates a test to all modules in the concentrator. All LEDs should respond by lighting continuously for approximately five seconds. Any LED that does not light is defective.

After the 5 seconds elapse, the diagnostic continues with a network (channel) check of all modules. Each Status LED should respond by blinking the number of times to correspond with the network to which the module is assigned. The network check sequence repeats 5 times. Table 3-6 explains the network check codes.

Table 3-6. Network Check Codes

LED State	Network Configuration
1 Blink	Module or port is configured for network 1
2 Blinks	Module or port is configured for network 2
3 Blinks	Module or port is configured for network 3
Off	Module or port is isolated (operates independent of any network)

4 *Troubleshooting*

This chapter describes fault conditions and troubleshooting procedures for the ONline Ethernet 10BASE-FB Modules.

This chapter contains the following sections:

- ❑ Troubleshooting Using the Port Activity LEDs
- ❑ Troubleshooting Using the Port Status LEDs
- ❑ Technical Assistance

Troubleshooting Using the Port Activity LEDs

If a port Activity LED does not light, use Table 4-1 to help troubleshoot the problem.

Table 4-1. Troubleshooting Using the Port Activity LEDs

LED State	Possible Cause	Corrective Action
Off	There is no traffic received from the segment.	None.
	Port is disabled.	Use the EMM to check if the port is enabled or check the port dip switch setting.
	Power is off.	Check the Controller Module Power LEDs.
	Activity LED has burned out.	Press the LED check button on the Controller Module.
	10BASE-FB Module port is faulty.	Connect the cable to a different port.
	10BASE-FB Module is faulty.	Try a different 10BASE-FB Module.
	Backplane connection is bad.	Reinsert the 10BASE-FB Module. If this fails, try another concentrator slot.

Troubleshooting Using the Port Status LEDs

A blinking Port Status indicator is always a sign that the port detects a potential problem. Once a port detects a problem, you can further analyze the problem by counting the number of blinks. Table 4-2 provides troubleshooting suggestions for each of the blinking sequences.

Table 4-2. Troubleshooting Using the Port Status LEDs

LED State	Indication	Possible Cause	Corrective Action
Off	Port Disabled	Port disabled.	Enable port.
		10BASE-FB Module not powered up.	Check concentrator power status. Reinsert the 10BASE-FB Module.
		Broken LED.	Press the LED check button on Controller Module.
		Bad 10BASE-FB Module.	Replace module.

Table 4-2. Troubleshooting Using the Port Status LEDs (Continued)

LED State	Indication	Possible Cause	Corrective Action
1 Blink	No Light Received	Cables crossed.	Verify TX on remote device is connected to RX on 10BASE-FB Module.
		Insufficient optical power received.	Check 10BASE-FB Module optical power using a light meter.
			Try High power on remote device.
			Check optical power of remote device.
			If optical power levels are OK, check cable; it may be bad or too long.
		Broken fiber cable.	Check and fix RX fiber link.
		Bad fiber connections.	Clean and reconnect fiber (both ends).
		Bad remote device or port.	Replace remote device or try another port.
		Bad 10BASE-FB Module.	Replace module.

Table 4-2. Troubleshooting Using the Port Status LEDs (Continued)

LED State	Indication	Possible Cause	Corrective Action
2 Blinks	Jabber	Loop in network.	Disconnect each link in the network one at a time to isolate the loop.
		Bad 10BASE-FB Module.	Replace module.
3 Blinks	Partition	Looped fiber cable.	Remove looped cable.
4 Blinks	Remote Fault	Remote device detects a problem.	Check remote device's status LEDs to identify problem.
		Bad remote device.	Try another port or replace device.
		Bad 10BASE-FB Module.	Replace the module.

Table 4-2. Troubleshooting Using the Port Status LEDs (Continued)

LED State	Indication	Possible Cause	Corrective Action
5 Blinks	Invalid Data	Receive light intensity too high.	Verify that received optical power level is correct. Refer to Chapter 2 (Link Distances).
		Connection made to 10BASE-FL Module.	Unplug the connection. 10BASE-FL is not compatible with this 10BASE-FB Module.
		Bad fiber connections.	Clean and reconnect fiber (both ends).
		Broken or cracked fiber.	Check and fix RX fiber link.
		Bad remote device.	Try another port or replace device.
		Bad 10BASE-FB Module.	Replace the module.
6 Blinks	Low Light Received	Low light received.	Verify optical power received is at low end of optical power budget by doing an optical power calculation. If value is acceptable, disable low light detection.
		Legal configuration with acceptable low light.	Disable low light detection or enable High power at remote end.

Technical Assistance

You can receive assistance for installing and troubleshooting the 10BASE-FB Module by calling either your 3Com reseller or 3Com Technical Support. Be prepared to supply a representative with the following information:

- ☐ Description of the problem
- ☐ Steps you have taken to try and correct the problem
- ☐ Type and software version of the ONline network management module being used
- ☐ Version of software installed on your 10BASE-FB Module
- ☐ Status of the front panel LEDs
- ☐ Configuration of your concentrator
(you may find it helpful to refer to the Slot Usage Chart in Appendix B of the *ONline System Concentrator Installation and Operation Guide* for a record of this information)

Refer to Appendix B for instructions on contacting Technical Support for your product.

A *Specifications*

This appendix lists specifications for the Port-Switching 10BASE-FB Module and the 10BASE-FB Module. Specification differences between the Port-Switching 10BASE-FB Module and the 10BASE-FB Module are indicated.

Specifications for the modules include:

- ❑ General Specifications
- ❑ Optical Specifications
- ❑ Power Specifications
- ❑ Environmental Specifications
- ❑ Mechanical Specifications
- ❑ Miscellaneous Specifications
- ❑ 3Com 10BASE-FB Network Products
- ❑ 10BASE-FB Cables and Connectors Specifications

General Specifications

Table A-1 lists general specifications for the 10BASE-FB Module.

Table A-1. General Specifications

10BASE-FB Module Model Numbers	5102M-FBP 5104M-FBP 5104M-FB1
Collision Detection	100% deterministic
Configuration Rules	Compliant with IEEE 802.3 10BASE-FB specifications
Jabber Protection	10.8 ± 1 msec
Maximum Number of Nodes	1024
Backplane Interface	96-pin edge connector, compatible with the ONline System Concentrator
External Connector	4 pairs of fiber ports (ST, SMA, or FC connectors)
Host Interface	ONline System Concentrator bus interface standard
Installation Attachment	Two thumbscrews on the mounting bracket

Optical Specifications

This section lists the optical specifications for the 10BASE-FB Module, including:

- ❑ Transmitter Specifications
- ❑ Receiver Specifications
- ❑ Supported Fiber Optic Cables
- ❑ Fiber Optic Interface

Transmitter Specifications

Light Source: GaAlAs LED at wavelength 820 ± 20 nm. Power coupled into fiber cable inclusive of ST, SMA, or FC connector loss.

Table A-2 lists normal and high power transmit specifications.

Table A-2. Transmit Power

Cable Type	Normal Power	High Power
100/140 micron, 0.29 NA fiber	- 11.5 dBm (± 3.0 dBm)	- 4.5 dBm (± 2.25 dBm)
85/125 micron, 0.29 NA fiber	- 14.0 dBm (± 3.0 dBm)	- 7.0 dBm (± 2.25 dBm)
62.5/125 micron, 0.275 NA fiber	- 17.0 dBm (± 3.0 dBm)	- 10.0 dBm (± 2.25 dBm)
50/125 micron, 0.20 NA fiber	- 21.5 dBm (± 3.0 dBm)	- 14.25 dBm (± 2.25 dBm)

Receiver Specifications

Table A-3 lists receiver specifications for the 10BASE-FB Module.

Table A-3. Receiver Specifications

Light Detector	Silicon PIN photodiode
Input Range	Optical power input of -8.0 dBm to -30.0 dBm
Bit Error Rate	1 in 10^{10} over dynamic range
Dynamic Range	22.0 dB

Supported Fiber Optic Cables

You can use the following fiber optic cables with the 10BASE-FB Module:

- ☐ 50/125
- ☐ 62.5/125
- ☐ 85/125
- ☐ 100/140

The fiber optic cable must be:

- ☐ Micron diameter graded index
- ☐ Duplex fiber
- ☐ 150 MHz km rating or better

Fiber Optic Interface

Table A-4 lists specifications for the fiber optic interface.

Table A-4. Fiber Optic Interface Specifications

Data Rate	10 Mbps (million bits per second)
Data Modulation	Manchester
Diagnostic Modulation	Pulse Width
Fiber Optic Interface	ST-, SMA-, and FC-type
Signaling	Compatible with all 10BASE-FB and 10BASE-FB products

Power Requirements

Table A-5 lists power requirements for the 10BASE-FB Module.

Table A-5. Power Requirements

Power Requirements	1.7 Amp @ 5 V
Fuse	4.0 Amps for 5 V, Fast blow
Power Consumption	8.5 Watts
BTU/hour	29.0

Environmental Specifications

Table A-6 lists electrical specifications for the 10BASE-FB Module.

Table A-6. Electrical Specifications

Operating Temperature	0° to 50° C (32° to 122° F)
Storage Temperature	-30° to 65° C (-22° to 149° F)
Humidity	Less than 95%, non-condensing

Mechanical Specifications

Table A-7 lists mechanical specifications for the 10BASE-FB Module.

Table A-7. Mechanical Specifications

Dimensions	1.0" W x 10.25" L x 8.5" H (2.54 cm x 26.04 cm x 21.6 cm)
Weight	1.25 lb. (0.57 kg.)

3Com 10BASE-FB Network Products

This section describes the fiber Ethernet products available from 3Com. In addition to the Ethernet 10BASE-FB Modules described in this guide, the following fiber products are available from 3Com:

- ❑ **3Com 10BASE-FB Transceiver** - The 3Com 10BASE-FB Transceiver (Model Number 5101T-FB) connects a device to the fiber network. The 10BASE-FB Transceiver has an AUI port and a fiber port. The AUI port connects to the device through the transceiver cable. The fiber port connects to the fiber network.

- ❑ **3Com Fault-Tolerant 10BASE-FB Transceiver** - The 3Com Fault-Tolerant 10BASE-FB Transceiver (Model Number 5102T-FBFT) provides fault tolerance to-the-desktop. The transceiver connects an existing network to a fault-tolerant fiber backbone network. It also provides a fault-tolerant network connection for a mission-critical device.
- ❑ **3Com 10BASE-FB Star Coupler** - The 3Com 10BASE-FB Star Coupler (Model Number 9308S-FB) is a pure fiber hub that provides both backbone and to-the-desk connectivity.

10BASE-FB Cable and Connector Specifications

This section contains information on 10BASE-FB cables, and connectors. Use the information in the following sections to ensure that the cables and connecting hardware meet requirements.

You can use many types of fiber cables and connectors to link your 10BASE-FB Module to your network. These cables and connectors are explained in the sections that follow. For proper operation, use only approved cables when you install all equipment.

10BASE-FB Cables

The fiber optic cable diameters that the 10BASE-FB Module supports must meet the following qualifications:

- ❑ 50/125, 62.5/125, 85/125, or 100/140 μm graded index fiber
- ❑ duplex fiber with a 150 MHzKm rating or better

Note that network link distances are affected by the grade of cable you choose. The quality of fiber cable varies significantly. Typically, measure quality in terms of the signal loss per km. The less amount of loss, the better the cable quality. Good quality 62.5 μm fiber typically has a 3 to 4 dB loss per kilometer.

10BASE-FB Connectors

The 10BASE-FB Modules are available in both SMA-type, ST-type, and FC-type fiber connectors for direct connection to a Fiber Ethernet LAN. When you order a 10BASE-FB Module, use the part numbers listed in Table A-8 for the correct connector type.

Table A-8. 10BASE-FB Module Part Numbers

Connector Type	Port-Switching 10BASE-FB Fiber Module	10BASE-FB Fiber Module
ST-type	5104M-FBP-ST 5102M-FBP-ST	5104M-FB1-ST
SMA-type	5104M-FBP-SMA 5102M-FBP-SMA	5104M-FB1-SMA
FC-type	5104M-FBP-FC 5102M-FBP-FC	5104M-FB1-FC

Connecting Fiber Cables

If you use a concentrator in your network setup, connect cables first at the active concentrator location. Refer to the *ONline System Concentrator Installation and Operation Guide* for more information about the concentrator connections and configuration rules.

B *Technical Support*

3Com provides easy access to technical support information through a variety of services. This appendix describes the following services:

- ☐ On-line Technical Support
- ☐ Support from Your Network Supplier
- ☐ Support from 3Com
- ☐ Returning Products for Repair
- ☐ Accessing the 3Com MIB
- ☐ 3Com Technical Publications

On-line Technical Support

3Com offers worldwide product support through the following on-line systems:

- ☐ Email Technical Service
- ☐ World Wide Web Site

Email Technical Support

You can contact the Integrated Systems Division (formerly Chipcom) on the Internet for technical support using the e-mail address techsupp@chipcom.com.

World Wide Web Site

You can access the latest networking information on the 3Com World Wide Web site by entering our URL into your Internet browser:

<http://www.3Com.com/>

This service features news and information about 3Com products, customer service and support, the 3Com latest news releases, selected articles from 3TECH™, the 3Com award-winning technical journal, and more.

You can contact the Integrated Systems Division on the World Wide Web by entering our URL into your Internet browser:

<http://www.chipcom.com/>

There are links between both WWW pages to view information from all 3Com divisions.

Support from Your Network Supplier

If additional assistance is required, contact your network supplier. Many suppliers are authorized 3Com service partners who are qualified to provide a variety of services, including network planning, installation, hardware maintenance, application training, and support services.

When you contact your network supplier for assistance, have the following information ready:

- ☐ Diagnostic error messages
- ☐ A list of system hardware and software, including revision levels
- ☐ Details about recent configuration changes, if applicable

If you are unable to contact your network supplier, see the following section on how to contact 3Com.

Support from 3Com

If you are unable to receive support from your network supplier, technical support contracts are available from 3Com.

For direct access to customer service for Integrated Systems Division products in:

- ☐ U.S.A. and Canada - call (800) 724-2447
- ☐ Asia Pacific - call (508) 787-5151
- ☐ Europe - refer to the table below. For European countries not listed, call 31 30 60 299 00.

Country	Telephone Number
Belgium	0800 71429
Denmark	800 17309
Finland	0800 113153
France	05 917959
Germany	0130 821502
Ireland	1 800 553117
Italy	1678 79489

Country	Telephone Number
Netherlands	06 0227788
Norway	800 11376
Spain	900 983125
Sweden	020 795482
U.K.	0800 966197
U.S.	800 876-3266

For access to customer service for all 3Com products, call (800) 876-3266.

You can also contact the Integrated Systems Division (ISD) on the Internet by using the e-mail address techsupp@chipcom.com.

Returning Products for Repair

A product sent directly to 3Com for repair must first be assigned a Return Materials Authorization (RMA) number. A product sent to 3Com without an RMA number will be returned to the sender unopened, at the sender's expense.

To obtain an RMA number for Integrated Systems Division products (formerly Chipcom), use the following numbers.

Country	Telephone Number	Fax Number
U.S. and Canada	(800) 724-2447	(508) 787-3400
Europe	(44) (1442) 275860	No Fax
Asia Pacific	(508) 787-5296	(508) 787-3400

Accessing the 3Com MIB

The 3Com Management Information Base (MIB) for the Integrated Systems Division describes commands that enable you to manage 3Com SNMP-based products. The MIB is available over the Internet on an anonymous FTP server. Updates to these MIBs are released as new 3Com products are introduced.

To access Internet versions:

1. FTP to `ftp.chipcom.com` (151.104.9.65).
2. Enter the login name `anonymous`.

3. Enter your full Internet e-mail address as the password (for example, `jdoe@company.com`).
4. Change to the mib or schema directory using the `cd /pub/mibs` or `cd /pub/mibs/schemas` command.
5. To view the 3Com MIB, OID, or schema entries, enter the `dir` command.
 - ☐ To pause the display, press [CTRL-S].
 - ☐ To continue the display, press [CTRL-Q].
6. Copy the MIB, OID, or schema files to your current directory using the appropriate command (for example, `get chipcom.mib`).
7. To exit the FTP session, invoke the `quit` command.

3Com Technical Publications

If you have comments or questions on 3Com Integrated Systems Division Technical Publications documents, please contact the Technical Publications group by FAX (508) 229-1551.

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